effectively would require the rest of the world to conform to the U.S. approach, whereas a band segmentation sharing plan has much greater flexibility for purposes of international coordination.

(3) The Commission should adopt the secondary allocation for MSS downlinks in the 1613.8-1626.5 MHz band. The only applicant that proposes to use the secondary allocation for its downlinks is Motorola. Secondary MSS downlinks from the Iridium™ system will not cause harmful interference to the primary uplinks of any of the proposed MSS systems. To the extent such interference might occur, Motorola can use different techniques, such as frequency and beam avoidance, to reduce interference to a non-harmful level;

(4) FDMA technology provides a peak traffic demand capability in both time and geographic areas because of the ability to redirect power from idle to high traffic density beams. CDMA systems under the interference sharing rule cannot serve peak demand loads;

(5) The lack of adequate spectrum to meet the service requirements of all of the applicants, particularly with all of the 16.5 MHz of S-band and up to 6 MHz of the 16.5 MHz of L-band spectrum severely restricted by existing services and applications.

DESCRIPTION OF MOTOROLA'S BAND SEGMENTATION PLAN

Under Motorola's band segmentation plan, all qualified applicants would receive a permit to construct their proposed systems over both bands in their entirety or as much thereof as they have requested in their applications. Thereafter, each licensee would remain subject to stringent construction, launch and operation milestones, whereby its license would be subject to revocation for failing to meet the conditions in its license.

The first system to operate would have access to the entire band (or to the 1616-1626.5 MHz band in the case of Motorola). If systems with

both access technologies become operational, then the 16.5 MHz uplink band would be partitioned into two equal segments based upon access technology (FDMA/TDMA vs. CDMA). If only one access technology ultimately develops, then systems using that technology would be authorized in the entire band.

The CDMA operators would share their entire uplink spectrum on an interference sharing basis. Interference sharing refers to the technical sharing criteria proposed by the CDMA applicants. FDMA/TDMA operators would share their band on a dynamic sharing basis, whereby they would periodically adjust their subband partitions based upon originating and terminating billed minutes of use in accordance with a set formula established in advance by the FCC.

When required, the FDMA/TDMA subband would occupy the upper half of the uplink band (1618.25-1626.5 MHz) and the CDMA subband would occupy the lower half of the band. When subsequent systems become operational, they would occupy the subband devoted to their particular access technology.

NEED FOR OUT-OF-BAND EMISSIONS AND ATTENUATION LIMITATIONS

Motorola, as well as most of the other applicants, have recognized a need to update and clarify the Commission's existing rules regarding out-of-band emissions and attenuation limits for MSS stations. All of the applicants have proposed that Section 25.202 of the Rules be amended to specify a power spectral density mask measured relative to the average in-band PSD at the maximum design power setting.

The proposed MSS systems have varying bandwidth and modulation types. An adequate PSD mask will protect other services and MSS systems from the sum of the out-of-band emissions from many overlapping CDMA carriers or multiple side-by-side FDMA carriers. The current rule, which specifies out-of-band PSD relative to the transmitter carrier power, does not adequately account for multiple carriers. In addition, a PSD mask can more adequately be applied to systems with varying bandwidths. The proposed rules specify emission limits in terms of out-of-band PSD

across each band segment which will control interference between dissimilar system types.

Motorola further recommends that the Commission consider changing its reference bandwidth for these rules from 4 kHz to 3 kHz. A 3 kHz integration bandwidth, unlike the current 4 kHz reference bandwidth, is available on standard test equipment which will simplify measurements.

LACK OF HARMFUL INTERFERENCE FROM SECONDARY DOWNLINKS INTO PRIMARY UPLINKS

The Commission should authorize MSS secondary downlinks in the 1613.8-1626.5 MHz band in accordance with the decisions reached at WARC-92. No special operating conditions or criteria need be applied to these secondary downlinks. The Commission's rules and regulations already provide adequate protection to primary MSS uplinks from harmful interference by any secondary service. In this regard, it should be noted that "harmful interference" is defined in the Commission's Rules as follows:

> Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunications service operating in accordance with these Radio Regulations.

47 C.F.R. 2.1 (Emphasis added).

In most cases, the Iridium™ system's secondary downlinks will not be operating in the same frequency bands over the same coverage areas as the primary MSS uplinks of other systems. This is because the Iridium™ system downlinks and uplinks use the same frequencies and its uplinks cannot share spectrum with any of the proposed CDMA and FDMA systems on a co-frequency, co-coverage basis. There does not appear to be any dispute that the out-of-band emissions of the Iridium™ system downlinks will be sufficiently attenuated to avoid harmful interference to the MSS uplinks of other systems in adjacent bands.

Under some circumstances, Iridium™ system downlinks could operate co-coverage, co-frequency with other systems. For example, the Iridium™ system might operate in other regions of the world on different frequencies than it does in the United States. Motorola's analysis of this potential interference situation, however, confirms that such occurrences will be occasional and not continuous, and that the amount of any interference (in terms of power) into a victim satellite will be extremely small. Moreover, such interference is not likely to be harmful to the uplinks of other systems since it will be dwarfed by the interference received from Iridium's primary uplinks plus the interference from any other MSS systems operating in these bands. More importantly, the Iridium™ system will be able to avoid causing harmful interference by various mitigation techniques, such as frequency and beam management.

Motorola requires use of secondary downlinks in the L-band because the MSS downlink band (2483.5-2500 MHz) is not suitable for FDMA downlink transmissions. Motorola's business plan calls for highly reliable, ubiquitous service to handheld units anywhere in the world. The IRIDIUM™ system has therefore been designed with high link margins to overcome shadowed and fading conditions expected in real operating environments. There are at least three fundamental obstacles to meeting these objectives with S-band downlinks. First, the regulatory trigger on power flux density in that band simply will not permit sufficient downlink power to meet Motorola's service objectives. Second, coordination of the S-band downlink with all of the fixed services in the band would be virtually impossible. Third, the ambient noise in most metropolitan areas due to Industrial, Scientific and Medical (ISM) applications -- primarily microwave ovens -- is substantially above the noise floor of the MSS receivers that would operate in this band.

REALIZABLE CAPACITY AND PERFORMANCE OF PROPOSED SYSTEMS

FDMA/TDMA and CDMA systems are proposed to operate under band segmentation rules. The overall channel capacities and spectral efficiencies available from FDMA/TDMA systems are superior to the collective realizable capacities of CDMA systems sharing spectrum on an interference sharing basis.

Band segmentation also allows each applicant to operate in the manner proposed in their respective applications, and to proceed with their business plans and access technologies. This is because interference between systems under these rules are controlled by frequency and geographical separation. This allows FDMA systems to increase beam power to satisfy peak traffic demand conditions without affecting traffic in other beams of the same system or in other systems. In fact, FDMA/TDMA systems are designed with peak to average demand factors on the order of ten.

Band segmentation also allows system operators to serve different MSS markets. For example, the Iridium™ system primarily will serve handheld terminals in virtually all propagation conditions anywhere in the world. On the other hand, CDMA systems will not be able to serve all of these customers in an interference sharing environment.

Motorola's analysis of CDMA capacity and performance levels varies significantly from those obtained by the proponents of CDMA technology. In Motorola's view, the CDMA applicants have made unrealistic assumptions concerning the operation of their systems in an interference sharing environment, and have ignored or failed to adequately consider various effects which will degrade their performance and/or decrease their capacity estimates. For example, even with dual diversity operation, dynamic range limitations were found to be significant for all of the proposed CDMA systems. Even at an assumed lowest power sharing level, only two of the five systems could share spectrum on a co-frequency, co-coverage basis. Moreover, those systems that will be unable to close their links for a fixed fade criterion will have to lower their service quality in order to continue to serve customers as more systems are introduced. Similarly, operation at lower power sharing levels in order to meet fade objectives will result in a loss of capacity.

ANALYSIS OF SHARING OPTIONS

Motorola's band segmentation sharing plan will meet all of the Commission's policy objectives for MSS, and is far superior to the CDMA applicants' full band sharing plan.

First, band segmentation will maximize multiple entry by permitting multiple technological approaches to be implemented, and by facilitating multiple system operations. The FDMA/TDMA, FDMA and CDMA applicants have proposed fundamentally different system designs based upon their respective "visions" of the marketplace and service objectives. Motorola primarily expects to serve handheld terminals with low dropped-call rates and high quality service virtually anywhere in the world. Motorola describes its vision as "Global PCS" because it believes that customers will demand an MSS service that can provide highly reliable service to small, lightweight terminals while they are travelling anywhere in the world. Several of the CDMA applicants have repeatedly asserted this same vision, however, their system designs clearly will not be able to accommodate the same users with the same service objectives. At least for their first generation systems, they will not be able to provide high quality MSS service to handheld users in many urban areas and during difficult propagation conditions. They also believe that their market objectives can be met with less than complete and continuous coverage, and without providing peak traffic demand service in any geographic area or during certain periods of time.

Some form of band segmentation is necessary to accommodate both types of technological approaches. All of the members of this working group admit that the IRIDIUM™ system and the proposed CDMA systems cannot operate on the same frequencies under the full band sharing rules proposed by the CDMA proponents. Motorola has further indicated that it will not be able to meet its business plan objectives if it had to change its system design radically, as suggested by the CDMA applicants. In any event, such fundamental modifications to the Iridium™ system still would not permit viable co-frequency sharing. Motorola simply cannot proceed with a system design that fails to meet the service requirements that it believes the market will demand.

On the other hand, Motorola's band segmentation sharing plan does afford both the CDMA and the FDMA proponents with a means of sharing the available spectrum. Under this plan, the marketplace, rather than regulatory fiat, will make the ultimate determination as to whether one or both of these technological approaches will succeed.

Second, there is no merit to the criticism that Motorola's plan improperly gives equal treatment to access technologies rather than to the number of applicants. Under this plan, the first operational system would use the entire uplink band. It is only when the next system with a different access technique becomes operational that the uplink band is split in half. Thus, if one of the proposed access technologies never results in an operational system, the entire uplink band would be devoted to a single modulation technique. Moreover, an equal division of spectrum by access technology, when and if it becomes necessary, gives proponents of each vision of the marketplace sufficient bandwidth to start providing service, and does not prejudge market and technology developments. Any other approach would reward spectrally inefficient systems and penalize high-capacity systems. For example, any division of the spectrum based upon the number of applicants would be inappropriate because the current number of applicants proposing a particular access technology is not a reliable indicator of the amount of spectrum that will be needed to accommodate real operations systems.

Third, Motorola's plan would accommodate some system growth and potentially new MSS systems. In the short term, both FDMA/TDMA and CDMA systems would be able to grow incrementally into the band allocated to its respective access technology as customer demand increases. Depending upon the number of the current group of applicants that ultimately become operational, there may also be room in the band for future applicants. In the long term, however, the limited amount of spectrum under consideration in this proceeding may only be sufficient to satisfy the first generation requirements of two or three high-capacity systems. This would be true whether the bands are devoted entirely to CDMA systems or band segmented by technology. It is for this reason that Motorola proposed at the beginning of this process that the Committee consider additional MSS spectrum in order to accommodate future applicants, as well as to allow for growth of licensed systems.

Fourth, Motorola's plan permits the award of construction permits to all qualified applicants, thereby avoiding any mutual exclusivity concerns. While there may not be adequate spectrum to accommodate all of the proposed systems, it is reasonable to expect that only a few of them will

ever become operational. Under Motorola's plan, if a permittee fails to become operational within a fixed period of time, it will be because the applicant did not succeed in the marketplace, and not because the Commission denied it the opportunity to go forward. On the other hand, the CDMA applicants' full band sharing plan would require the Commission to dismiss at least one of the applicants based upon its choice of technology.

Fifth, under Motorola's plan domestic coordination could be administered as readily as under a full band sharing approach. From an administrative standpoint, Motorola's band segmentation plan is self-implementing; i.e., once a system is authorized and becomes operational, the specific frequencies are predetermined. In addition, adjustments to the FDMA/TDMA subband, if more than one such system became operational, could be easily accomplished without Commission involvement based upon a predetermined formula using actual billed minutes. Such adjustments ensure that spectrum will not be warehoused by any operator and encourage all operators to use the spectrum in an efficient manner by rewarding performance in the marketplace.

Sixth, international coordination should be much easier to accomplish under a band segmentation plan than under an interference sharing plan. International coordination would be accomplished in accordance with the procedures developed at WARC-92. Historically, such coordination of satellite systems has involved FDMA and FDMA/TDMA geostationary satellite systems and the process of coordinating systems employing such modulation techniques is well understood. FDMA/TDMA LEO systems, such as the Iridium™ system, are frequency, bandwidth and beam agile, which should help facilitate international coordination with foreign systems. In addition, Motorola's band segmentation plan does not dictate a particular access technology to the rest of the world. Foreign CDMA systems could be accommodated in the lower portion of the band, while foreign FDMA systems could be coordinated in the upper portion of the band.

In this regard, the CDMA applicants fail to recognize that their plan not only fails to allow for any domestic FDMA/TDMA system, but also does not consider possible international coordination with a foreign

FDMA/TDMA system. In the latter case, band segmentation would be required in order to accommodate these foreign systems.

Report of Motorola
on Band Segmentation Sharing

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REPORT OF MOTOROLA ON BAND SEGMENTATION SHARING TO WORKING GROUP 1 OF THE ABOVE 1 GHz NEGOTIATED RULEMAKING COMMITTEE

1.0 BACKGROUND

This Report will describe a proposed method of achieving multiple entry and sharing among satellite systems in the 1610-1626.5 MHz and 2483.5-2500 MHz MSS/RDSS bands on the basis of Interference Sharing and Band Segmentation Sharing.[1] Applications to provide mobile satellite services (MSS) and radio determination satellite service (RDSS) have been filed by six corporations: Constellation Communications, Inc. (Constellation), Ellipsat Corporation (Ellipsat), Loral Qualcomm Satellite Services (LQSS), Motorola Satellite Communications, Inc. (Motorola), TRW Inc. (TRW), and American Mobile Satellite Corporation (AMSC) (MSS-only). Celsat, Inc. (Celsat) has indicated an intention to file an application to use the MSS/RDSS bands.

At the 1992 World Administrative Radio Conference (WARC-92), spectrum was allocated internationally for MSS in these bands on a primary basis. The band 1613.8-1626.5 MHz was also allocated for MSS downlinks on a secondary basis. Subsequently, the Federal Communications Commission ("FCC" or "Commission") proposed to allocate the 1610-1626.5 and 2483.5-2500 MHz bands to MSS (in ET Docket 92-28) and convened this Negotiated Rulemaking proceeding (CC Docket 92-166). The charter of the Negotiated Rulemaking Committee (the "Committee") states that "[t]he purpose of the committee is to provide recommendations to the Federal Communications Commission to be used in the formulation of technical rules governing the provision of mobile satellite services (MSS) operating in the 1610-1626.5 MHz (Earth-to-space), 1613.8-1626.5 MHz (space-to-Earth), and 2483.5-2500 MHz (space-to-Earth) frequency bands. The Committee will also assist the FCC in resolving questions relating to (1) the maximum sharing of available frequencies for mobile satellite services, and (2) coordination of these services with existing and future terrestrial and/or satellite services, domestically and internationally." (MSSAC-1.)

The Committee has created three Working Groups. The Committee's Work Program directs Working Group 1 to "[r]ecommend modifications to the existing rules for these bands (47 C.F.R. §25.141), or new rules as necessary, to

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[1] Annex 1.0 shows the MSSAC and IWG-1 documents associated with each part of this Report.

maximize multiple entry and to avoid or resolve mutual exclusivity among the non-geostationary satellite applicants, and between proposed non-geostationary and proposed or authorized geostationary satellite systems, while maintaining the economic viability of the systems." (MSSAC-1)

The FCC has stated that "[a]pplicants filing by the cut-off date [June 3, 1991] will be afforded an opportunity to amend their applications, if necessary, to conform with any requirements and policies that may be adopted for satellite systems in these bands." (Report No. DS-1068 (April 1, 1991).)

Motorola advocates a band segmentation proposal which it has presented in IWG1-3 and IWG1-34. Other members of the drafting group have identified other band segmentation approaches, which are under consideration. These approaches include segmenting the band by number of applicants, by channelization, and by dynamic band sharing. These approaches are contained in IWG1-51.

1.1 Nominal Parameters of Proposed Systems

In general, the applicants have described a variety of services, which include near-toll quality voice, data, paging, facsimile, and RDSS (position determination) to users with handheld and/or vehicular terminals domestically and, in some cases, internationally. Five applicants have proposed to offer such services through a network of low or medium earth orbiting (LEO) satellites. The sixth applicant (AMSC) proposes to provide services within the United States in the same bands using geostationary (GEO) satellites. Celsat also proposes to use geostationary satellites in conjunction with terrestrial facilities. The fact that several other administrations have submitted advance publication information to the International Frequency Registration Board for use of these bands indicates that some non-U.S. entities may be interested in constructing MSS systems.

This section contains a brief description of the proposed MSS/RDSS

systems and some of the nominal parameters of each system.[2] (See also Section 1.4, where a tabulation is given for the frequency plan, modulation and channelization scheme of each system.)

1.1.1 Constellation

Constellation proposes a LEO satellite system that it calls "Aries", which would provide voice, data, facsimile and RDSS. The proposed system consists of 48 satellites in 4 planes in polar orbits at an altitude of 1020 km above the Earth. As originally filed, Constellation proposed to use SCPC/FDMA uplink transmissions from user terminals and TDM transmissions spread over the 16.5 MHz downlink to user terminals. The system is now under review to increase satellite capacity and will use CDMA access techniques across the 16.5 MHz allocated for user terminal uplink transmissions.

1.1.2 Ellipsat

Ellipsat proposes a satellite system, known as "Ellipso", to provide voice, data, facsimile and RDSS. Ellipsat initially plans to build, launch, and operate 6 LEO satellites, and eventually to increase capacity by expanding to a maximum of 24 satellites. It currently proposes to operate the satellites in inclined elliptical and equatorial circular orbits with a maximum altitude of around 7800 km. Ellipsat claims that its use of elliptical orbits would optimize coverage of the United States with a minimum number of satellites. It plans to operate this system using channelized CDMA digital spread spectrum techniques.

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[2] The information in Section 1 of this Report was provided by each applicant and represents a combination of data from the applications, other FCC filings, current thinking on system design and considerations to maximize the shared use of the MSS/RDSS bands by authorized entities. See Sections 5 and 6 of this Report for additional explanation.

1.1.3 LQSS

Loral Qualcomm Satellite Services proposes a LEO system called "Globalstar" that would provide voice, data, facsimile, and RDSS services. The Globalstar system would use a network of 48 satellites in inclined orbit at 1414 km above the Earth. It plans to use a channelized CDMA access technique, based closely on the wideband CDMA digital cellular telephony standard currently being finalized by the Telecommunications Industry Association (TIA).

1.1.4 Motorola

Motorola proposes a system known as "Iridium", to offer voice, data, facsimile and RDSS services. Motorola has proposed bi-directional operation in the 1616-1626.5 MHz band. The Iridium system would be composed of 66 LEO satellites in 6 polar orbit planes at an altitude of 780 km above the Earth. Each satellite would be capable of demodulating user signals, and cross-linking them to adjacent satellites. The system would use an FDMA/TDMA access format.

1.1.5 TRW

TRW has proposed a system known as "Odyssey" to provide voice, data, facsimile, and RDSS services. The Odyssey system would employ 12 satellites, four each in three orbital planes, in a medium-earth orbit at an altitude of 10,370 km. The Odyssey system would employ dynamically steerable satellite antennas and channelized CDMA access techniques.

1.1.6 AMSC

AMSC, the U.S. domestic MSS licensee in the 1545-1559 MHz and 1646.5-1660.5 MHz bands, has requested that the Commission also license it to operate in the 1616.5-1626.5 MHz band and a complementary downlink band on its second and third geostationary satellites to be located at 62° and 139° West Longitude. AMSC states that it needs access to additional spectrum because of limitations imposed on access to its

licensed bands due to international coordination. AMSC proposes to use CDMA or narrowband FDMA access techniques.

1.1.7 Celsat

Celsat has not filed an application with the FCC. In its filings in ET Docket 92-28 and RM-7827, however, Celsat has described its "Celstar" concept as comprising a hybrid terrestrial/satellite system which would utilize two redundant geostationary satellites. It has proposed an FDMA/CDMA access format, closely based on the FDMA/CDMA digital cellular telephony standard currently being finalized by the TIA.

Table 1.1
Constellation Parameters

Company/ System	No. of Satellites	Orbit Altitude (Km)	Satellite Beams
AMSC/	2	GEO 62° W/139°W	4
Constellation/ Aries	48	1020	7
Ellipsat/Ellipso	6, later 24	580/7800	8
LQSS/Globalstar	48	1414	6
Motorola/Iridium	66	780	48
TRW/Odyssey	12	10,370	19
Celsat/Celstar	2	GEO 76° W/116°W	149

1.2 Resources Available

The FCC has proposed (in ET Docket 92-28) to allocate domestically two 16.5 MHz bands for MSS on a primary basis: an uplink band from 1610-1626.5 MHz and a downlink band from 2483.5-2500 MHz. This allocation for MSS would be co-primary with the existing allocation for RDSS in these bands. The FCC has proposed a secondary MSS downlink band at

1613.8-1626.5 MHz. These band proposals are consistent with allocation decisions made at WARC-92.

1.3 Description of Known Bandsharing Considerations

There are several sharing considerations on the use of these bands. First, the lower part of the uplink band (1610.6-1613.8 MHz) is allocated internationally to Radio Astronomy Service (RAS) on a co-primary basis. MSS and RDSS providers must coordinate use of this part of the spectrum with RAS.

Second, Aeronautical Radionavigation Service (ARNS), for example, the Russian GLONASS system, share primary status in one of the bands internationally. GLONASS has been coordinated with the United States in accordance with Footnote 732 and Article 14 in the band 1602-1616 MHz. GLONASS currently operates a space-to-earth link in the band 1602-1616 MHz, and has advance published with the IFRB for the GLONASS-M system up to 1620.6 MHz.

A number of footnotes to the ITU's Table of Allocations affect the use of the band. International Regulation 731E states:

> The use of the band 1610-1626.5 MHz by the mobile-satellite service (Earth-to-space) and by the radiodetermination- satellite service (Earth-to-space) is subject to the application of the coordination and notification procedures set forth in Resolution 46 (WARC-92). A mobile earth station operating in either of the services in this band shall not produce an e.i.r.p. density in excess of -15 dbW/4 kHz) in the part of the band used by systems operating in accordance with the provision of No. 732, unless otherwise agreed by the affected administrations. In the part of the band where such systems are not operating, a value of -3 dbW/4 kHz) is applicable. Stations of the mobile-satellite service shall not cause harmful interference to, or claim protection from, stations in the aeronautical

radionavigation service, stations operating in accordance with the provisions of No. 732 and stations in the fixed service operating in accordance with the provisions of No. 730.

In addition to Footnote 731E, the FCC has proposed the adoption of several other international footnotes which were approved or modified at WARC-92. These footnotes are set forth below:

731E -- The use of the band 1613.8-1626.5 MHz by the mobile-satellite service (space-to-Earth) is subject to the application of the coordination and notification procedures set forth in Resolution 46.

733E -- Harmful interference shall not be caused to stations of the radio astronomy service using the band 1610.6-1613.8 MHz by stations of the radiodetermination-satellite and mobile-satellite services (No. 2904 applies).

734 -- In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the radio astronomy service in the band 1610.6-1613.8 MHz from harmful interference. Emissions from space or air-borne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. 343 and 344 and Article 36).

753E -- The use of the band 2483.5-2500 MHz by the mobile-satellite and the radiodetermination-satellite services is subject to the application of the coordination and notification procedures set forth in Resolution 46. Coordination of space stations of the mobile-satellite and radiodetermination-satellite services with respect to terrestrial services is required only if the power flux-density produced at the Earth's surface exceeds the limits in No. 2566. In respect of assignments operating

> in this band, the provisions of Section II, paragraph 2.2 of Resolution 46 shall also be applied to geostationary transmitting space stations with respect to terrestrial stations.

International Footnotes 727 and 730 provide additional L-band allocations to the Fixed Service on a secondary and primary basis, respectively, in certain foreign countries.

As set forth in Section 7 of this Report, IWG1 received inputs from IWG2 relating to the use of the 1610-1626.5 MHz band by other services.

Third, the downlink band (2483.5-2500 MHz) is also allocated domestically and internationally to various terrestrial services and applications on a primary basis. In the U.S., fixed service systems operate in the band pursuant to U.S. footnote NG 147. To avoid interference to the terrestrial services, WARC-92 set in Footnote 753F a coordination trigger level of -142 dBW/m^2/4kHz on the downlink PFD from each satellite (and a lower PFD level at low elevation angles, see ITU RR 2566).

Fourth, WARC-92 allocated the 1613.8-1626.5 MHz band (space-to-earth) on a secondary basis, whereas the MSS uplinks in the 1610-1626.5 MHz band are allocated on a primary basis.

1.4 Proposed Frequency Plans, Modulation and Channelization Schemes

The following table depicts the proposed systems' frequency plans, modulation and channelization schemes as currently envisioned:

Table 1.2
Summary of Frequency Plans, Modulations & Channelization Schemes

Company/System	Modulation	Multiple Access Method (Forward Link)	Multiple Access (Return Link)	Channelization (MHz)	Frequency Band (MHz)
Constellation	QPSK	Spread TDM	Channelized CDMA	16.5 forward 1 to 5 return	1610-1626.5 2483.5-2500
Ellipsat	OQPSK	Channelized CDMA	Channelized CDMA	1.1	1610-1626.5 2483.5-2500
LQSS	QPSK	Channelized CDMA	Channelized CDMA	1.25	1610-1626.5 2483.5-2500
Motorola	DE-QPSK	FDMA/TDMA	FDMA/TDMA	41.67 KHz	1616-1626.5
TRW	BPSK	Channelized CDMA	Channelized CDMA	5.5	1610-1626.5 2483.5-2500
AMSC	QPSK	CDMA (or FDMA/TDMA)	CDMA/FDMA (or FDMA)	5.5 (or 6 KHz)	1616.5-1626.5 2483.5-2500*
Celsat	QPSK	Channelized CDMA	Channelized CDMA	1.25	1610-1626.5 2483.5-2500

* AMSC has indicated an intention to amend its applications to use the 2483.5-2500 MHz band for downlink operations.

ANNEX 1.0

WORK PLAN REFERENCING ASSOCIATED MSSAC AND IWG1 DOCUMENTS

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Report of Motorola on Band Segmentation Sharing

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April 1993

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1.0 Background (IWG1-15, 43)

- 1.1 Nominal parameters of proposed systems
- 1.2 Resources available
- 1.3 Description of known bandsharing considerations
- 1.4 Proposed frequency plans, modulation and channelization schemes

2.0 Description of Band Segmentation Sharing (MSSAC-15, IWG1-3, 34)

3.0 Description of Technical Sharing Criteria

4.0 Operating Conditions and Criteria Necessary to Protect Primary Uplinks from Secondary Downlinks (IWG1-21, 25, 35, 63)

5.0 Realizable Capacity/Performance analysis of Proposed Systems Operating under the Technical Sharing Criteria (IWG1-19, 26, 43, 49, 59, 64, 70)

- 5.1 Introduction
- 5.2 FDMA/TDMA vs. FDMA/TDMA
- 5.3 LEO vs. GEO
- 5.4 CDMA vs. CDMA
- 5.5 FDMA/TDMA and CDMA capacities under band segmentation sharing rules

Identification of Referenced Documents

Document No.	Description
MSSAC-15	Iridium: Personal Communications for the World
MSSAC-42	Report of IWG2
IWG1-3	Motorola Presentation on Band Segmentation
IWG1-4	USSG 8D-14/Rev. 6
IWG1-15	Motorola: Information Required for Compatibility Assessment Among CDMA MSS Applicants
IWG1-19	Motorola Presentation on Interference Problems with Multiple Co-Coverage, Co-Frequency CDMA Systems
IWG1-21	Motorola: Preliminary Analysis of IWG1-9 (CCIR Doc. 8D/Temp 81)
IWG1-25	Motorola: Response to Comments on Self-Interference
IWG1-26	Motorola: FDMA/TDMA-FDMA/CDMA Co-coverage Spectrum Sharing
IWG1-27	Motorola: A Step Towards Consensus
IWG1-28	Motorola: Why Iridium System Cannot Use the 2483.5-2500 MHz Band
IWG1-34	Motorola: Proposed Spectrum Assignment Policies
IWG1-35	Motorola: Can Iridium Downlinks in L-Band Share with LEO Uplinks

IWG1-42	Status Report of IWG2/Drafting Group 2A to IWG1 on RAS
IWG1-43	System Parameters: Status Report
IWG1-48	Motorola: International Coordination of CDMA Systems Under Band Segmentation
IWG1-49	Motorola: Capacity Analysis Uplink Spectrum, CDMA Systems
IWG1-53	Status Report of IWG2 - Drafting Group 2B
IWG1-57	Motorola: CDMA Uplink Analysis
IWG1-59	Motorola: CDMA vs. FDMA Downlink Capacity Analysis
IWG1-63	Motorola: Critique of CCIR Temporary Document IWG1-9
IWG1-64	Motorola: Uplink Analysis for CDMA Systems
IWG1-70	Motorola: On the Performance of a CDMA System Operating over LEO Satellite Links